high school and the college. Except that the author has burdened himself needlessly with the Herbartian terminology, which often tends to obscure what for plain and uninitiated readers might easily have been treated more simply, there is little but praise to be given to the manner in which the book discusses in detail the numerous topics which come under review. For example, in treating of early and infant education, Mr. Findlay analyses with much ingenuity and force the true meaning of Fröbel's teaching, and helps the reader to distinguish between the essential verity which underlies that teaching and the travesty of it, which too often satisfies the merely mechanical kindergarten instructor. He shows that

> "The final value of Fröbel, as of his master Pestalozzi, is to be found rather in the spirit of his work than in the particular devices he employed." "Instead," he says, "of the tedious and useless paper-folding 'occupations,' which are a part of the Fröbel fetish, we may find it possible even with little children to cultivate the decorative art; they may trace the snowdrop pattern on flannel or cardboard, and then cut it out to stitch or paste on to darker material serving thus as a rug or tablecloth to please mother at home, as something of service to her. Taste on the teacher's part quickly develops appreciation for simple forms of beauty."

In like manner, this book shows how easy it is for even the best theories of enthusiasts to degenerate into formalism and pedantry, unless the nature of child-life and the possibilities of intellectual development are looked at with fresh eyes, and unless teachers can emancipate themselves from traditional methods. This is well illustrated by the chapters in which the claims of the humanities are examined both in their relation to later childhood and to more advanced stages of progress. At first, "Robinson Crusoe" and the "Odyssey," "Tales of Greek Mythology," the story of Joseph and his brethren and that of King Alfred are cited as examples of narratives which are likely to touch the imagination and arouse the sympathy of the learner none the less because they are remote from his present environment and experience. They

> "bring family relations into prominence. Odysseus never forgets Ithaca; the tragedy of Joseph's life centres round his father's home. The child is still a home-bird, and in the humanities, above all, this sentiment must find a place right through into boyhood."

On the subject of teaching science, Mr. Findlay rightly insists on the importance of such preliminary training as may awaken the faculty of observation and kindle in the pupil an interest in the phenomena of the visible world before proceeding to the technicalities of science as generally understood in schools. The true scope and meaning of "Nature-study" as a means of giving the basis of ideas and experience on which formal lessons on science may hereafter be wisely built are thought out and explained with much care.

Throughout the book, the author shows himself to be a faithful disciple of Herbart, and enforces in various ways the need of kindling interest and securing the co-operation of the scholars in the business of learning:

> "The child is supremely an active being, and it must be the teacher's care, not only to provide suitable material for thought, but for action. Hence, in our scheme of a curriculum we shall recognise the arts and occupations of the young in drawing, in music, in games, in manual training, as worthy to take rank side by side with those branches of knowledge which, since the Renaissance, have sought to usurp the whole field. In so doing, we shall be simply reverting to the older and more generous method of the Greeks."

Space forbids further detailed reference to the ways in which the author has sought to illuminate the path of the teacher and to define his aims. There are some disputable propositions in the book, and good teachers will not be unanimous in approval of all the methods recommended. But it will suffice here to say that the author's effort to find a rational explanation of the best practical and professional rules has been successful and that the book will take rank among the most thoughtful contributions to educational science which have appeared in recent years.

J. G. F.

A WORK ON SURVEYING.

Surveying, as Practised by Civil Engineers and Surveyors, Including the Setting-out of Works for Construction and Surveys Abroad, with Examples taken from Actual Practice. By John Whitelaw, jun. Pp. xiv + 516. (London: Crosby Lockwood and Son, 1902.)

THIS book cannot be considered altogether satisfactory or as fulfilling the purpose the author proposes to himself. One gathers from the short preface that it is his intention to present a useful text-book of principles and methods for students, as well as a guide to the actual practice of surveyors and civil engineers in the various branches of surveying. This is a sufficiently ambitious programme, and for its successful accomplishment it demands, not only a practical training in the field, but some facility of mathematical manipulation, since there must be constant reference, not only to the methods and details of actual measurement required for various practical purposes, but to the theory of instruments, the application of the theory of errors, geodetic problems and the principles involved in hydrographic surveying.

Up to a certain point, we have the greatest confidence in our author. Wherever he is describing work of which he has had actual experience, he is a welcome guide. In various commercial undertakings, such as the preparation for railroads, or waterworks, there is abundant evidence that his work is competent and trustworthy; but to write a book on the lines proposed, more is needed than familiarity with practical surveying within a limited area. One begins to lose confidence when he reads what the author calls the theory of the sextant, but which is limited to the demonstration of an elementary proposition in geometrical optics. It is true, at a later stage the author gives rules for the practical adjustment of the sextant, but such ordinary matters as the errors produced by a prismatic form of the index glass, or by the inclination of the index or horizon glass are either entirely ignored or not brought before the student with the necessary detail.

This confidence sinks still lower when we get a rule for the determination of the probable error from two

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observations only. One feels that the theory of errors has not been grasped with a complete mastery. After glancing at such uncomfortable-looking formulæ as $BC' = d \tan (BAC + 0{\cdot}000069\, d)$ and wondering whether there is any advantage in such forms of expression as cos. of co-dec., in place of the more familiar Sin. dec., we turn to the section on longitude determination to learn how the method is practised by civil engineers and surveyors. And in this chapter one learns some strange things. It does not appear to be at all necessary to take into account the parallax of the moon in the method by lunar distances, and the problem of "clearing the distance," a problem fraught with much pain and anxiety to many, does not seem to trouble engineers and surveyors. Similarly, the longitude by lunar occultations is treated with equal lightness and brevity. We are told that the Greenwich mean times of the occultations of fixed stars by the moon are given in the *Nautical Almanac* for both immersion and emersion, and that by applying the approximate longitude in time, the approximate local mean time of the occultation may be found, and the observer will know approximately when to begin to observe. We recommend the two or three pages of explanation of the section "Elements of Occultation" given at the end of the *Nautical Almanac* to the author's attention.

These remarks are not made in any unkind spirit, but, if possible, to warn the student to what extent he may trust his author. We can readily believe that with his chain and his theodolite, the writer of the book has done, and will continue to do, good work, and if he had been content to describe accurately what he knew thoroughly, he would have given us a valuable practical treatise. But he has ventured on subjects of which his experience has not qualified him to treat, and in these directions we can neither follow him with satisfaction nor unreservedly recommend his book to the careful study of the large class of students who might have profited by it.

W. E. P.

PROTOZOAN NATURAL HISTORY.

Faune Infusorienne des Eaux stagnantes des Environs de Genève. Par Dr. Jean Roux, Assistant au Laboratoire de Zoologie de l'Université de Genève. Pp. 148; 8 plates. (Genève: H. Kundig, 1901.)

Faune Rhizopodique du Bassin du Léman. Par Dr. Eugène Penard. Pp. 714. (Genève: H. Kundig, 1902.)

THE systematic study of the natural history of the Protozoa in past years has, in general, lagged far behind that of the higher groups of animals. In large part, no doubt, this has been due to technical difficulties of collection and examination, but it has resulted also from a delay in recognition of the fact that the same problems of species and of their geographical distribution which have stimulated and directed the detailed study of Metazoan natural history for so many years have equivalent applicability and interest among the Protozoa. The brilliant labours of Ehrenberg, however, who concerned himself largely with the local distribution of Protozoan forms, and the later work of Bütschli, have been increasingly fruitful. The conception by Bütschli of the "cosmopolitanism" of the Protozoa has been supported by the results of numerous workers in various countries and continents, and found its fullest sanction in the studies of Schewiakoff during his voyage round the world. Schewiakoff, indeed, by showing in how large a proportion the Protozoan species already well known in Europe were spread through other continents, opened the most attractive field for the study of the problem of species among the unicellular animals.

The two valuable monographs we now owe to Drs. Roux and Penard will rank high among the later contributions to the Protozoan natural history. Concerned as they are with the exact description of a purely local fauna, they may be considered to be in a sense complementary to the extensive researches of Schewiakoff—they have a value which is intensive, rather. With the general idea of Protozoan ubiquity and specific "cosmopolitanism" well grounded, we may hope that by the sufficient accumulation of exact local studies, and perhaps in no other way, we may eventually see unravelled the intricate relationships of nutritive conditions and of the environment in general, not only to secondary body characters, but to the processes of fission and its secondary developments, which determine to so large a degree the life-histories of the Protozoa. Not the morphologist alone, but the physiologist too, will welcome the advances of our knowledge in this direction, for the latter must hope to gain a widely increased outlook upon the significance and origin of many cellular processes by the determination of the phylogenetic relationships among groups of Protozoa.

Dr. Jean Roux has collected, identified and described in detail the species of Infusoria occurring in the stagnant waters, in pools, marshes and basins in the neighbourhood of Geneva. His work gives fresh verification, if any were required, to the very generalised distribution of Protozoa throughout the world, for he has already found in his own district three-fifths of all the forms of non-marine Infusoria which have been described for other countries. His arrangement of the species follows Bütschli's classification, except in the order Holotricha, in which the divisions of Schewiakoff are adopted. Very complete systematic descriptions are given of every form, the arrangement and shape of its organs, its characteristic movements, and, in most cases, its normal *habitat* and mode of nutrition.

The text is illustrated by well executed coloured plates, which give figures, drawn by the author, of about 170 species. Some interesting points are raised by Dr. Roux in connection with the seasonal changes of population among the Infusoria. Statistical inquiry has shown that the population of a given species exhibits maxima and minima of seasonal incidence. In general, a maximal population is found both in spring and autumn, a fact which has not yet received adequate explanation. These two maxima may be real; they may be due to increased reproductive activity both in preparation for, and in con-

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